ORIGINAL ARTICLE

Total laparoscopic bladder resection in the management of deep endometriosis: "take it or leave it." Radicality versus persistence

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Abstract

Background Bladder endometriosis (BE) is the most common external site of deep-infiltrating endometriosis (DIE) affecting the urinary tract. Frequently associated with other DIE lesions, it can be strongly related to a ventral spread of adenomyosis. Possible symptoms are urinary frequency, tenesmus and hematuria, and they are frequently related to DIE of the posterior and lateral compartment. Hormonal therapy can be used in non-symptomatic patients; conversely, in other cases surgical treatment is the management of choice.

Methods Retrospective cohort study of a series of consecutive patients treated between September 2004 and December 2017 in a tertiary care referral center. Only full-thickness detrusor involvement was considered as BE. All patients underwent laparoscopic bladder resection with concomitant radical excision of DIE.

Results BE was found in 264 patients and was associated with simultaneous bowel DIE requiring bowel resection in 140 patients (53%). Twenty-five patients (9.5%) had associated obstructive ureteral signs requiring ureteroneocystostomy. Mean hospital stay and time of catheter removal were 9.7 and 9.1 days, respectively. Postoperative major complications (< 28 days) were observed in 19 patients (7.2%). Follow-up was performed at 1, 6 and 12 months after surgery, with a 2.3% recurrence rate observed.

Conclusions Laparoscopic partial cystectomy for BE is a feasible and safe technique, and experienced laparoscopic surgeons should consider it the gold standard treatment. Surgical eradication leads to excellent surgical outcomes in terms of reduction of symptoms and recurrence rates, considering the need to maintain an adenomyotic uterus for fertility purposes.

Keywords Bladder endometriosis · Laparoscopic cystectomy · Bladder suturing · Deep-infiltrating endometriosis · Segmental bowel resection

Introduction

Deep infiltrating endometriosis (DIE) is defined as implantation of endometrial glands or stroma at least 5 mm deep into the retroperitoneal space or pelvic side walls [1].

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Endometriosis deposits can also be found in other pelvic or abdominal organs, including the urinary tract and bowels, which are the most common sites of extragenital endometriosis. The incidence of urinary tract involvement is reported to range from 0.3 to 12%, according to a recent review [2], with the bladder being the most common site of urinary tract endometriosis, accounting for about 84% of all cases [3].

Bladder endometriosis (BE) is defined as endometriosis infiltrating the detrusor muscle either partially or full thickness [2], sparing the mucosal layer in most cases. Bladder involvement is unlikely to be an isolated phenomenon, as it presents alongside other localizations of pelvic endometriosis [4]. In most cases, BE is a consequent ventral spread of adenomyosis [5].

As for other sites of extragenital endometriosis, several theories try to explain the pathogenesis of BE, such as the embryogenic theory, stating a possible origin from the Müllerian remnants, located especially in the vesicouterine

septum [5]; the metastatic theory, postulating a retrograde reflux of endometrial cells into the pelvis through the fallopian tubes implanting on the bladder wall [2]; the transplantation theory, originating as an extension of adenomyotic lesions and transport through lymphogenous or hematogenous paths [6, 7]; or the iatrogenic theory, stating that BE may be caused by intraoperative dissemination of endometrial cells or a suboptimal technique for closure of the low transverse uterine incision [2].

Diagnosis of BE is often challenging. In fact, one third of the patients are asymptomatic. Nevertheless, 70% of women with bladder endometriosis present with urinary symptoms as an acute urethral syndrome with frequency, tenesmus, burning sensation, dysuria, suprapubic discomfort and pelvic pain [5, 8, 9]. Symptoms are frequently cyclic and recur with menses. Hematuria seems to be a less frequent symptom, being described by 20–35% of patients, probably because the lesion does not reach the mucosal layer [10].

In endometriosis referral centers, BE diagnosis is based on clinical symptoms, pelvic examination, transvaginal ultrasound (TVUS), diagnostic cystoscopy and supplementary imaging techniques.

Medical treatment has been the first line of therapy, which has been proven to provide successful pain relief [11]. However, symptoms may relapse even during or following completion of medical treatment. Bladder lesions appear to respond suboptimally, which may be explained by a detrousal muscle desmoplastic reaction secondary to recurrent bleeding and inflammation from deep endometriotic nodules [10]. Nonetheless, surgical treatment is generally considered effective, ensuring long-term pain relief in almost all cases.

Eradication of BE can be achieved surgically by performing either a full resection of the BE or partial cystectomy [12]. Conversely, disease recurrence has been reported after transurethral resection or peritoneal (pericystium) excision [13].

The purpose of this retrospective study is to show the outcomes of a large series of patients affected by BE and concomitant DIE who underwent laparoscopic surgical treatment in our referral center, assessing surgical efficacy, feasibility and safety.

Materials and methods

Patient selection and preoperative methods

This is a retrospective study collecting a series of consecutive patients who were referred to our center for a history of DIE and scheduled for radical laparoscopic DIE excision between September 2004 and December 2017. Inclusion criteria for BE laparoscopic treatment included patients who did not respond to hormonal therapy and those who presented with hematuria or with a bladder localization close to one or both ureteral ostia, suffering from hydroureteronephrosis, or with concomitant suboccusive bowel involvement. Asymptomatic women with DIE and documented bladder involvement were excluded from our study and referred to clinical follow-up; also patients with intraoperative involvement of only the peritoneal bladder surface were excluded.

Patients were evaluated and treated by a multidisciplinary team consisting of gynecologists, urologists and general surgeons, particularly well trained for laparoscopic endometriosis surgery.

Before surgery, every patient underwent a preoperative workup, rectovaginal examination, abdominal scan and TVUS. Pain (dysmenorrhea, pelvic pain, dyspareunia, dysuria, dyschezia, cyclic sciatica and/or pudendal/anogenital pain) was evaluated using an interview-based questionnaire evaluated using a 10-point visual analog scale (VAS): 0 = absent and 10 = unbearable.

A double-contrast barium enema or magnetic resonance imaging (MRI) was performed in case of suspicion of bowel-related endometriosis. In case of mild-severe hydroureteronephrosis, a computerized tomography (CT) urogram scan and kidney scintigraphy were performed, giving a possible indication for ureteroneocystostomy. When bladder involvement was suspected based on the patient's symptoms, ultrasound or previously executed examinations, an outpatient cystoscopy was performed to assess the mucosal involvement and location related to both ureteral ostia. This study was approved by the institutional review board of IRCCS Sacro Cuore-Don Calabria hospital.

Data on patient age, parity, body mass index (BMI), previous abdominal-pelvic surgery, operating time, amount of blood loss, length of hospital stay, recovery of bladder and bowel functions following surgery, duration to open bowels, time to resume voiding function, and intra, early and late postoperative complications were recorded in a digital database.

A double-J ureteral catheter was positioned when the lesion involved the bladder trigone, when the nodule was found < 2 cm from the ureteral ostia or if associated ureteral involvement was detected either pre- or intraoperatively. Pigtail stents were left in place for 6–8 weeks depending on the extension of the ureterolysis, presence of an ureteroneocystostomy or if sutures were very close to the trigone. During the preoperative workup, all women had detailed counseling, receiving an explanation regarding the possible risks and benefits associated with the surgical procedure, and signed an informed consent.

All patients received bowel preparation with 20 ml oral Phospho-Lax (Sofar, Trezzano Rosa, Milan, Italy ®), diluted in a glass of water, followed by 1 l of water, for 3 consecutive days. Prophylactic antibiotic therapy was administered 30 min before induction of anesthesia. The operation time was calculated from umbilical incision to the closure of laparoscopic port scars.

Blood loss during surgery was estimated by measuring the aspirated blood volume.

Intraoperative procedures

Laparoscopic treatment for DIE was carried out as previously described in other papers [14, 15]. Laparoscopy started with pneumoperitoneum using a Veress needle and the subsequent introduction of a 10-mm laparoscope in the standard umbilical position. Then, three 5-mm trocars were inserted under direct vision supra-pubically in each midquadrant of the abdomen laterally to the inferior epigastric vessels. Adhesiolysis and complete excision of pelvic endometriotic lesions were performed using 5-mm bipolar scissors (BissingerMedizintechnik GmbH, Germany), advanced bipolar energy devices (BiClamp, ERBE, GA, USA) and combined/ultrasonic energy devices (Thunderbeat, Olympus, USA; Harmonic ACE, Ethicon US, LLC).

After that, bladder demolitive/reconstructive surgery was performed by a gynecologist and/or urologist if a ureteroneocystostomy was required (Figure 1) .

BE treatment started with opening and development of anatomical spaces and septae, as previously described in other papers [15]. Both the medial and lateral paravesical spaces, Retzius' retropubic space, Bogros spaces (the caudad and lateral continuation of Retzius' space, bilaterally) and vescico-cervico-vaginal space were opened and fully developed [16, 17]. Then, detachment of the posterior bladder wall from the anterior uterine surface with the dissection of the vesicouterine space was performed. This allowed the surgeon to work in healthy tissue, defining the extension of bladder involvement, planning a precise bladder incision and achieving radical excision of the disease as well as a tension-free final suture (Figure 2).

Bladder wall opening and resection were obtained using bipolar scissors, a monopolar hook and combined energy and ultrasound devices, as previously described.

The bladder was then closed by double-layer intracorporeal laparoscopic running sutures, using Monocryl 3/0 (Polyglecaprone, Ethicon, Sommerville, NJ). At the end of the procedure, the bladder was filled with 180–240 ml 0.9% NaCl solution for watertight closure testing. Single strengthening stitches were applied if a leakage was noticed, and the filling test was repeated.

Concomitant adenomyosis was treated with argon beam coagulation in case of wide superficial involvement of the myometrium and with radiofrequency thermal ablation in case of deep nodular adenomyosis [18].

Ureteral endometriosis was treated according to the level of ureteral obstruction and extent of ureteral invasion [19]. Distal ureteral resection with ureteral reimplantation and bladder psoas hitch (if necessary) was performed when the nodule involved the bladder trigone. The bladder was sutured or hitched to the psoas muscle. Exposure of the exterior surface of the bladder mucosa was achieved by dividing the overlying detrusor muscle at the line of the intended ureteral implantation. An incision was then performed distally in the bladder mucosa. The ureter was spatulated, and a distal anchoring suture that included the muscle of the ureter as well as the bladder was performed. The ureter was anastomosed mucosa to mucosa over the existing ureteral stent. The bladder muscle and pericystium were then approximated to cover the distal ureter.

Eventual concomitant segmental bowel resection was performed by a colorectal surgeon. In case of concomitant

Fig. 1 **a** Laparoscopic surgical field of a severe deep-infiltrating endometriosis with massive involvement of both the anterior and posterior compartment. **b** Intraoperative diagnostic cystoscopy showing a full-thickness multifocal bladder nodular involvement. **c, d** Full-thickness bladder invasion, evaluating the distance from the right and left ureteral ostia
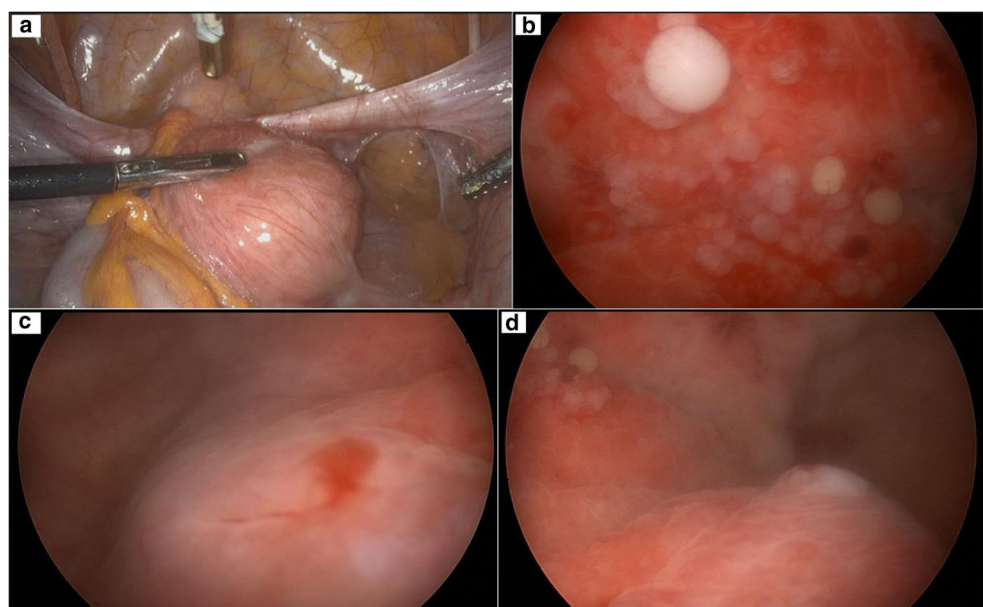
Fig. 2 **a** Laparoscopic view of a dissection of the anterior compartment showing a 3-cm bladder endometriosis nodule arising from anterior adenomyosis. **b** Bladder laparoscopic opening, with exposure of mucosal bladder involvement. **c** Complete bladder endometriosis excision, evaluating the healthy suturing margin from both ureteral ostia. **d** Final overview after laparoscopic suturing and intraoperative bladder filling test
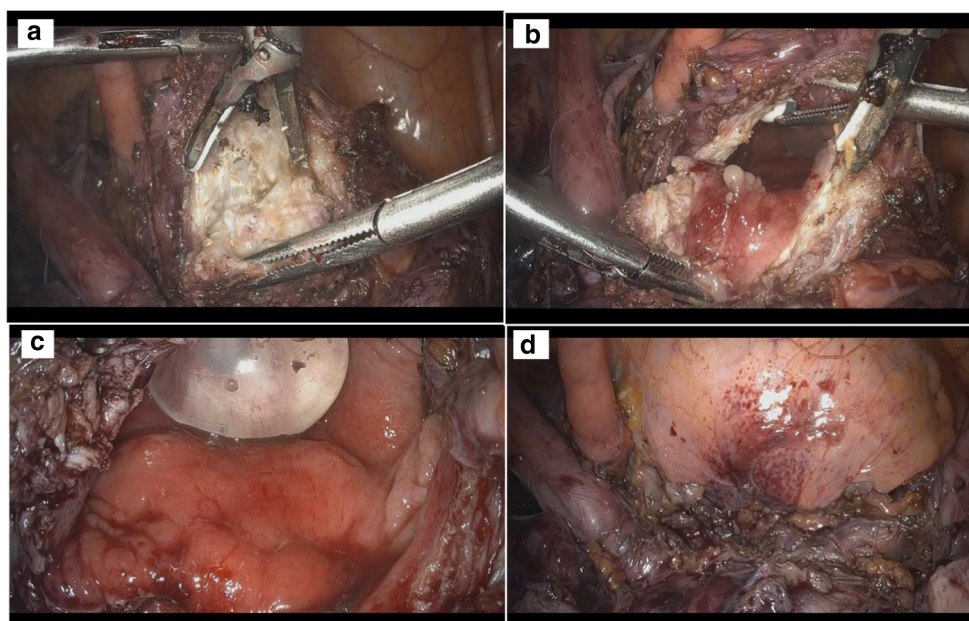
ureteroneocystostomy and bowel resection, a temporary ileostomy was always performed. This was not performed in cases where rectal shaving was undertaken.

Postoperative complications were defined as events that occurred within the first 28 days from the operation. Long-term complications were those that occurred after 28 postoperative days and until the end of follow-up.

Postoperative methods

Nasogastric suctioning was not routinely used. According to the anesthesiologist's recommendation, all patients were monitored in the intensive care unit and transferred to the gynecologic ward on the first day after surgery. For approximately 24 h after surgery, each patient received postoperative analgesia via a continuous intravenous infusion. Thereafter, analgesia consisted of intravenous ketoprofen (100 mg) and intramuscular tramadol (100 mg) or subcutaneous buprenorphine (0.3 mg) and was administered upon patient request.

Clear fluids were allowed the day following surgery, and oral intake was started the next day. All patients were discharged with no specific recommendations regarding oral intake. Pelvic drainage was withdrawn after the first bowel movement after an analysis of the peritoneal fluid creatinine levels, which could be related to a urinary tract leakage. The Foley bladder catheter was removed on day 7–10 after performing a cystography. In patients receiving concomitant parametrial resection, catheter removal was followed by self-catheterization or using a bladder ultrasound scan after spontaneous voiding until the detection of a normal post-voiding residual (PVR) < 100 ml on three consecutive assays. Patients performed intermittent self-catheterization at home if they experienced voiding difficulty or urinary retention > 100 ml at the time of discharge. The number of days of self-catheterization from discharge until resolution was recorded.

Gonadotropin-releasing hormone (GnRH) agonists were administered to all patients for 3–6 months, followed by oral progestin or combined estro-progestin therapies based on the woman's desire to conceive.

After discharge, all patients were clinically evaluated for the first time 1 month after surgery. Follow-up consisted of clinical examination, TVUS and an investigation to determine subjective well-being and the presence of short-term complications. During the follow-up period, all patients completed a questionnaire evaluating pelvic functions and quality of life at 1, 6 and 12 months after the surgery.

Patients' quality of life was also investigated through a section of the questionnaire assessing subjective perception of their status. The questionnaire was modified from Bergmark's series and assessed a quality of life score by 54 items that included sexual functions (according to DSM-IV criteria) and the psychologic status, according to the Short World Health Organization Quality of Life assessment [20–22]. This questionnaire had been previously adopted by our Gynecologic Oncology Division for the evaluation of pelvic functions and quality of life in oncologic patients after major radical pelvic surgery [23]. All patients provided a written informed consent agreeing to participate in the questionnaire part of the survey.

Women were also questioned about postoperative conception (data not considered in this report), any further surgery and changes in bowel, urinary and sexual function. The presence of urinary incontinence and/or difficulty in bladder emptying were evaluated as well as patients' self-assessment of bowel-rectal function, presence of fecal and/or air incontinence and their ability to distinguish air from feces. At the

12-month follow-up, relapse was considered as clinical detection and/or histologically proven evidence of recurrent disease.

Statistical methods

Continuous variables were reported as the mean ± 1 SD when a Gaussian distribution could be assumed; otherwise, they were reported as the median (interquartile range). Categorical variables were reported as absolute values.

Continuous variables were compared using Student's t-test for unpaired data, the Wilcoxon rank sum test or the two-independent variables k-test, as appropriate. Statistical analyses were performed using the SPSS for Windows 16.0 package (SPSS Inc., IBM Corp., Armonk, NY, USA).

Results

Two hundred sixty-four patients with BE were included in this study. Their demographic and clinical characteristics are presented in Table 1. Mean (SD) age was 36.8 (± 5.6) years; 230 (87.1%) were nulliparous, and 168 of these patients (63.6%) had undergone one or more previous surgical abdominal-pelvic procedures at the time of first observation. According to The American Fertility Society classification, all patients suffered from stages III–IV and had histopathologic validation [24]. Bladder symptoms consisted primarily of dysuria and hematuria. Other symptoms are presented in Table 1.

BE was associated with uterine adenomyosis in 81.3% of cases (215 patients) at transvaginal ultrasound preoperative assessment and in 91.3% of cases (241 patients) at intraoperative evaluation of the uterus. BE was correlated with bowel endometriosis and simultaneous DIE in the posterior cul-de-sac requiring bowel resection in 140 patients (53%); 2 of them underwent a disc resection (0.8%), while the others had segmental resection. Forty-nine women (18.6%) received a temporary ileostomy; 10 patients (3.8%) underwent rectal

shaving; 22 patients (9.5%) had associated ureteral lesions with obstructive signs and hydroureteronephrosis, requiring ureteroneocystostomy. Ileostomy was systematically performed in case of concomitant bowel resection and ureteroneocystostomy. Parametrectomy was performed in 151 patients (57.1%).

Median duration of surgery was 260 (range 60–600) min. There were no conversions to laparotomy. Mean hospital stay was 9.7 days (± 4.33 SD). There were no intraoperative complications. Median intraoperative blood loss was 205 (range 30–1700) ml.

Mean times of catheter removal and self-catheterization were 9.09 (± 6.40 SD) and 1.53 (± 2.41 SD) days, respectively. Nine patients were discharged with self-catheterization, but all recovered normal bladder function within the first 28 postoperative days (Table 2).

Major postoperative complications were defined as those encountered in the first 28 days after intervention and are reported in Table 3.

There were nine cases of suture leakage at cystography (3.4%); none required surgical correction. In all of these patients, the catheter was maintained for 20 more days and removed after a second negative cystography.

Major postoperative complications (< 28 days) were observed in 19 patients (7.2%) and were classified following the Clavien-Dindo system and reported as shown in Table 3 [25]. These included four cases of hemoperitoneum (1.6%),

Table 1 Patient characteristics and symptoms

Cases (264)	Mean ± SD or %
Age	36.8 (± 5.6 SD)
BMI (body mass index)	21.03 (± 3.26 SD)
Previous pregnancies	34 (13.2%)
Previous surgeries for endometriosis	168 (63.6%)
Dysuria	177 (67.1%)
Hematuria	50 (18.9%)
Dysmenorrhea	254 (96.1%)
Dyspareunia	170 (64.5%)
Dyschezia	146 (55.4%)

Values are mean ± SD or *n* (%)

Table 2 Preoperative diagnostic workup and intraoperative findings

Abdominal ultrasound	226 (85.6%)
Transvaginal ultrasonography	264 (100%)
Cystoscopy	201 (76.13%)
Nodule size at ultrasound (cm)	2.27 cm (± 0.62 SD)
Adenomyosis detected at ultrasound	215 (81.4%)
Adenomyosis detected intraoperatively	241 (91.3%)
Stage of disease (ASRM)	
III	33 (12.6%)
IV	231 (87.4%)
Duration of surgery (min)	260 (60–600)
Blood loss (ml)	205 (30–1700)
Bowel surgeries	152 (57.6%)
Rectal shaving	10 (3.8%)
Disc resection	2 (0.8%)
Segmental resection	140 (53%)
Ureteroneocystostomy	25 (9.5%)
Parametrectomy	151 (57.1%)
Temporary ileostomy	49 (18.6%)
Days of catheter removal	9.09 (± 6.40 SD)
Days of hospital stay	9.72 (± 4.33 SD)
Days of self-catheterization	1.53 (± 2.41 SD)

Values are *n* (%), mean ± SD or median (range)

Table 3 Complications (with Clavien-Dindo grading system for surgical complications)

Postoperative complications	< 28 days	> 28 days	C-D grading system
Suture leakage at cystography	9 (3.4%)	–	
Catheterization > 20 days	9 (3.4%)	–	
Re-interventions	19 (7.2%)	7 (2.7%)	IIIb
Vesico-vaginal fistula	2 (0.8%)	–	IIIb
Ureteral fistula		1 (0.4%)	IIIb
Vesical fistula	1 (0.4%)	–	
Ureteral stenosis	–	3 (1.1%)	
Intravesical bleeding	2 (0.8%)	–	
Uroperitoneum	1 (0.4%)	–	
Hemoperitoneum	4 (1.6%)	–	IIIb
Bowel-related complications	6 (2.3%)	3 (1.1%)	IIIb
Pelvic abscess	3 (1.1%)	–	IIIb
Blood transfusion	5 (2.2%)	–	II
Postoperative fever	32 (12.1%)	–	
Bladder endometriosis recurrence			
After 12 months (264 patients)		7 (2.3%)	
After 24 months (121 patients)		5 (4.1%)	

Values are n (%)

with patients that required surgery and blood transfusions, vesico-vaginal fistulas in two patients (0.8%), pelvic abscess in three cases (1.1%), uroperitoneum in one case (0.4%) and intravesical bleeding in two cases (0.8%), managed by cystoscopy. Six patients (2.3%) underwent surgery for complications related to bowel resection. There were no cases of anastomotic fistula. All of the complications were managed laparoscopically, with two patients presenting postoperative vesico-vaginal fistula receiving surgical repair.

Only 32 patients had hyperpyrexia above 38 degrees (12.1%) and were treated by intravenous antibiotic therapy. Major postoperative complications (> 28 days) were observed in seven patients, with three ureteral stenoses due to retroperitoneal fibrosis requiring ureteral reimplantation (1.1%), three patients who had bowel-related complications undergoing laparoscopic adhesiolysis and one patient with ureteral fistula, which was managed by 3-month pigtail positioning. There were no reported cases of recto-vaginal fistula or self-catheterization at > 60 days.

Postoperative data were collected during routine follow-up in the endometriosis unit of the department and included recording of postoperative symptoms and clinical examination. Patients were asked to compare their symptoms before and after the surgery and describe them as asymptomatic, marked improvement, no improvement or recurrence of symptoms.

Follow-up results were available for all 264 patients at 12 months.

The recurrence rate after 12 months of follow-up was 2.3% (6 patients). In the subgroup of patients with > 24 month follow-up (121 patients), five experienced BE recurrence (4.1%). All of the patients had concomitant widespread adenomyotic uterine involvement, but none underwent total hysterectomy and postoperative hormonal therapy because of the desire to have children.

Preoperatively, 254 patients had dysmenorrhea (96.1%), 170 dyspareunia (64.5%), 177 dysuria (67.1%), 50 hematuria (18.9%) and 146 dyschezia (55.4%). At the first follow-up, all patients reported absence of symptoms; only seven reported persistent urinary symptoms.

As seen in Table 4, histopathologic findings reported mean nodule diameter of 32.5 mm (± 13.04 SD). In all cases, the vesical serosa was involved and the infiltration reached the detrusor muscle. In 71 cases there was full-thickness infiltration involving the bladder mucosal layer (28.5%). Multifocal bladder nodules were found in five patients (2.1%).

Discussion

The prevalence of BE in a tertiary care endometriosis referral center may reach 4–5% of all women treated for DIE [26].

Accurate preoperative assessment for the evaluation of BE is essential for adequate preoperative counselling and subsequent complete surgical excision [2, 7].

Diagnosis of BE should be based on clinical symptoms, TVUS and diagnostic cystoscopy. As reported by several authors, the specificity, positive and negative predictive value of TVUS are about 100%; sensitivity on the other hand is < 50%, depending on the size of the nodule [27, 28]. All of our patients were evaluated with a TVUS, and 81.3% underwent outpatient cystoscopy, which was able to detect the presence of single or multifocal intraluminal BE and its distance from the ureteral ostia and the trigone. We found high concordance between mean bladder nodule size and the histopathologic assessment.

Diagnosis of BE is often challenging because patients might be asymptomatic: in fact, 33% of our patients did not report any bladder-specific symptoms and were treated surgically once medical treatment had been unsuccessful, suffering

Table 4 Histopathologic reports

Nodule size (mean, SD)	32.5 mm (± 13.04 SD)
Mucosal infiltration	71 (28.5%)
Muscular infiltration	264 (100%)
Serosal infiltration	264 (100%)

Values are n (%), mean ± SD

from posterior DIE-related symptoms. Dysuria was reported by 67.1% of patients (Table 1), while hematuria only by 18.9%, probably because bladder mucosal involvement is not a common finding, as confirmed by our histopathologic analysis. For the same reason, it is rare to find a rectal nodule causing rectorrhagia. There are other reported symptoms related to an acute urethral syndrome, such as frequency, tenesmus and urgency [2, 5, 9]. These symptoms are often reported as constant and cyclical but are accentuated during the premenstrual period [9].

Treatments of BE depend on the severity of urinary symptoms and are strongly related to the extent of the disease, patient age and the desire to conceive. Clinical management can be conservative (medical therapy), surgical or a combination of these. Medical treatment is generally considered a temporary solution for BE, but can definitely improve symptoms, although its discontinuation is associated with symptom relapse [2, 10]. Many reports describe excellent surgical outcomes for partial cystectomy in terms of reduction of symptoms, increased pregnancy rates and reduction of recurrence when complete excision of the disease is performed [2, 5, 12].

Most of our patients had posterior compartment involvement, with 140 patients undergoing a segmental bowel resection. For this reason, BE should be considered only part of the widespread disease in the pelvis, encouraging support for the retrograde menstruation etiopathogenic theory. Other theories that explain the possible development of isolated forms of BE may be acceptable, but these clinical presentations are very rare. Moreover, data support the need for a detailed and accurate preoperative workup and careful surgical approach (even multidisciplinary when necessary).

Almost 10% of our patients required a concomitant ureteral reimplantation, more commonly on the left side, according to the ureteral asymmetrical involvement reported in the literature [29]. As previous authors reported, we believe that BE is not associated with ureteral endometriosis, but is strongly related to DIE involving the posterior and lateral compartments [28, 30].

In our series, the recurrence rate after 12 months of follow-up was 2.3%. In the subgroup of patients with a follow-up > 24 months (121 patients), the recurrence rate was 4.1%. Our recurrence rate is extremely low compared with other data in the literature: other authors reported a recurrence rate of 10.5% and 5.8%, respectively [30, 31]. This aspect can probably be explained by the performance of radical surgery, when possible, primarily after unsuccessful medical treatment or after prolonged subfertility or recurrent failed fertility treatments. Moreover, all patients that underwent BE recurrence had severe adenomyosis and did not accept total hysterectomy or postoperative hormonal therapy because of the desire to have children. It is clear that the real "hidden enemy" after radical treatment for DIE is persistent adenomyosis, which needs to be accurately checked during follow-up.

To our knowledge, this is the largest series of patients with BE who underwent total laparoscopic treatment. All of the patients reported severe stage III–IV ASRM and presented with histologically confirmed BE in association with concomitant deep lesions involving the pelvis, recto-vaginal septum, utero-sacral ligaments, parametria, ureter, vaginal wall and rectum. In our experience, and according to recent reviews, radical excision of BE is the only effective long-term treatment, which has to include postoperative medical therapy to reduce recurrences. These surgeries require advanced knowledge of surgical anatomy, nerve-sparing laparoscopic skills and a multi-disciplinary approach [2, 24].

In our practice and according to the recent literature, BE appears to be related to ventral spread of concomitant uterine adenomyosis and/or DIE, so transurethral surgery should be considered an incomplete, improper and ineffective treatment, with recurrence rates reported up to 25–35% [10, 32, 33].

Our data suggest that laparoscopic bladder resection could be an effective surgical treatment regarding BE and might be considered a feasible, safe, radical and hopefully long-lasting treatment. Being so frequently associated with adenomyosis, the real challenge for surgeons and patients could be related to persistent symptoms secondary to adenomyosis [18], which will only be treated effectively by a total hysterectomy or suppressive hormonal therapy until the time of conception, whether spontaneous or with assisted reproductive techniques.

Compliance with ethical standards

Conflicts of interest   None.

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